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U. S. DEPARTMENT OF AGRICULTURE.
DIVISION OF BOTANY.

CONTRIBUTIONS

FROM

THE U. S. NATIONAL HERBARIUM.

Vol. VII, No. 2.

THE ORIGIN AND DISTRIBUTION OF THE COCOA PALM.

BY

O. F. COOK.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1901.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF BOTANY,
Washington, D. C., June 12, 1901.

SIR: I have the honor to transmit herewith a manuscript entitled, The Origin and Distribution of the Cocoa Palm, by Mr. O. F. Cook, Special Agent for Tropical Agriculture, which I recommend for publication as Contributions from the United States National Herbarium, Volume VII, No. 2.

Respectfully,

FREDERICK V. COVILLE,
Botanist.

Hon. JAMES WILSON,
Secretary of Agriculture.

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THE ORIGIN AND DISTRIBUTION OF THE COCOA PALM.

INTRODUCTORY.

Few groups of plants as widely distributed as the palms have their species, genera, and even families so strictly limited geographically. A large proportion of the genera are monotypic, and many of the species are confined to small islands or localized in equally circumscribed continental areas. Thus, not only are all the species and genera of American palms different from those of Asia, but several genera are peculiar to the intervening islands of the Pacific, though most of these are of Asiatic rather than of American affinities. To the above rule the generally credited Asiatic or Malayan origin of the cocoa palm has furnished the single exception, all of its relatives being American. Curiosity regarding the nature of the evidence by which such an anomaly of distribution could be established and explained has led, first, to a review of the data relating to the long known, though frequently forgotten, fact that the cocoanut was in America before the discovery of this continent by Europeans; and, second, to a belief that the supposed proof of the extra-American origin of the cocoanut is not only inadequate, but that the theory of such an origin is incompatible with numerous collateral facts.

In attempting to present an alternative view a remarkable amount of traditional error and confusion has been encountered; indeed, a thorough examination and elucidation of the misconceptions which have grown up about this question would require far more time and space than the discussion of gratuitous errors can ever deserve. And yet many of the points involved are of interest and importance outside the immediate problem, in that they relate to facts and inferences bearing upon all similar discussions, in which systematic biology and ecology are combined with anthropology, philology, history, and tradition. Finally, an immediate justification of a somewhat detailed discussion of the origin of the cocoa palm is to be found in the fact that it furnishes a not unfair example of the treatment which similar questions have received at the hands of De Candolle and others whose opinions are commonly cited with confidence by both botanists and

anthropologists. Thus the evidence of the existence of the banana in prehistoric America is equal, if not superior, to that here presented for the cocoanut. The banana and the sweet potato, both grown in cultivation only from cuttings, crossed the Pacific before the advent of Europeans; and this fact, not to mention here others of similar import, goes far to render probable the human distribution of the cocoa palm. At the same time it tends to demonstrate that the prehistoric trans-Pacific communication, of which evidence is now being sought with great diligence and expense in Alaska and Kamchatka, took place within the Tropics. An ecological investigation of the peoples of the shores and islands of the Pacific, giving special attention to the species and varieties of their food plants, might be undertaken with reasonable prospects of decisive results upon many questions now approached only by theory and conjecture, and upon which little light can be expected from the tribes of the polar regions, who long since left behind them, not only their tropical economic plants, but all the agricultural arts and habits which their remote ancestors may have possessed.

Owing to the great antiquity of the beginnings of agriculture the origins of many cultivated plants are involved in obscurity. A considerable proportion of our most important economic species are not known in their wild state, presumably because human selection has rendered their botanical relationships unrecognizable, or because the original wild forms have become extinct. Even in dealing with the origins of the temperate plants cultivated in the Mediterranean region there are many unsolved problems, notwithstanding the great amount of historical and philological testimony available, and it is thus only reasonable to expect that the confusion and uncertainty will be many times greater with the species domesticated in primitive tropical societies the existence and location of which are often little more than conjectural. Moreover, in the absence of formal records or historical remains, the plants themselves may prove to be the best obtainable clew to the locations and movements of prehistoric agricultural peoples. While in such matters we may not soon, if ever, attain to satisfactory definiteness and certainty, it is the more necessary to use every fact drawn from general biology or from other collateral sources as a view point from which less satisfactory evidence may be interpreted. Pickering was undoubtedly correct in believing that useful plants furnish man's best record of his own primitive existence. Unfortunately, that author, so zealous in collecting materials, did not have at his command the botanical knowledge required for establishing the identifications and origins of individual species, without which fixed points of departure can not be secured and distributional studies become a tangle of dry and worthless details.

CURRENT OPINIONS AND INFERENCES.

De Candolle's verdict on the origin of the cocoanut was rendered in rather impressive form, and has commanded more general confidence than even that author himself could have expected.

I formerly thought that the arguments in favor of Western America were the strongest. Now, with more information and greater experience in similar questions, I incline to the idea of an origin in the Indian archipelago. The extension toward China, Ceylon, and India dates from not more than three thousand or four thousand years ago, but the transport by sea to the coasts of America and Africa took place, perhaps, in a more remote epoch, although posterior to those epochs when the geographical and physical conditions were different to those of our day.¹

Martius, Spruce, and Wallace, the most eminent naturalists who have made detailed studies of the palms of South America, have all accepted without serious question the Asiatic or Polynesian origin of *Cocos nucifera*, though well aware that all the other species of the genus are natives of South America.

Eighteen species of *Cocos* are known, seventeen being natives of South America, principally of Brazil, while only one, the well-known cocoanut, is a native of the Old World, though it is now universally cultivated in every part of the tropics. Few species of the genus are found in the Amazon district. They appear to prefer drier and more elevated countries, some of them reaching an altitude of near 8,000 feet above the sea.²

Relying on such opinions a recent anthropological writer, with an appreciation of the advantages of direct communication, but with complete disregard of historical fact, has advanced the idea that the cocoanut and the banana were introduced by the Spaniards, not from the East, but from the West, and at a date subsequent to those of printed books containing accounts of both plants as existing in large quantities in America.

The presence in America of the banana, which, like the cocoanut, has been fancifully accounted for as the result of some prehistoric dissemination, bears witness to the contact with the East. The banana, which can be propagated only by living plants, came to Mexico by way of Manila within the last three hundred years and has been widely distributed over the tropics of America. The same is true of the plantain.³

¹ Origin of Cultivated Plants, p. 435. (London, 1886.)

² Alfred Russel Wallace, Palm Trees of the Amazon and their Uses, p. 124. (London, 1853).

³ American Anthropologist, 1900, p. 70. On the contrary, the Philippine varieties of the banana seem not to have been introduced into Mexico even yet. The early introduction from the Philippines of plants propagated by cuttings and short-lived seeds is also not to be assumed without proof, since the voyage to Mexico was much longer than the return journey, owing to the necessity of sailing around the north Pacific to secure favorable winds. Moreover, the sailing route from the Philippines to Mexico was not discovered until about forty years after the publication of Oviedo's account of the cocoanut and banana in America. Regular communication was not opened until another decade had passed.

Doubtless as a result of his studies in plant geography, Grisebach entertained a belief in the American origin of the cocoanut and placed its original habitat on the western coast of Panama.¹

The reasons for this opinion seem never to have been explained; but the indications are that Grisebach accepted De Candolle's suggestion that the cocoa palm did not occur normally on the American mainland, but at the same time appreciated the logical necessity of associating the species as closely as possible with the American palm flora. In any event, the Panama theory, while sometimes quoted out of deference to Grisebach's botanical reputation, has received no general attention or acceptance, and the belief in an Asiatic origin, with a possible maritime or accidental introduction to the islands of the Bay of Panama, is still generally held.

To De Candolle and other writers Seeman's objection to an American nativity has seemed adequate and incontrovertible, namely, the relatively small importance of the cocoa palm in America compared with its great and highly diversified utility on the shores and islands of tropical Asia. But, as suggested elsewhere, the abundance of other useful plants in America gave little incentive to specialization of the cocoanut, while the poverty of the indigenous floras of the Pacific islands focused human attention on the few species obtainable and led to the discovery of a great variety of secondary uses. Thus the Polynesians, for want of more suitable materials, make fish nets from the fibers of the yam bean (*Pachyrhizus*), one of the most primitive of tropical culture plants and probably of American origin, though the fiber is not known to be used either in America or in Asia, whither the plant was carried in prehistoric times.

But use is, after all, primarily a function of human skill and industry and may be no index of nativity. Nearly all the plants cultivated in the United States are of exotic origin, and a large proportion of the more important species came from the Old World. Moreover, if we think of the cocoa palm as having passed gradually across the Pacific, it is easy to understand that in addition to the uses discovered by the Polynesians there would be transferred to it when it approached the shores of Asia a large variety of requirements which had been met previously by some of the numerous economic palms native in the Malay region. Thus toddy or palm wine has been drawn since time immemorial from a considerable number of Asiatic and Malayan species by methods which it was not difficult to adapt to the cocoanut. This and many other human arts and adaptations which have been interpreted as indications of the very great antiquity of the species in Asia may possibly have been developed in connection with indigenous species and have been ready and waiting, as it were, for the arrival of the cocoanut.

¹ Flora of the British West Indies, p. 522 (1864).

IMPROBABILITY OF SPANISH INTRODUCTION.

The existence of the banana in prehistoric America has been obscured by the record of an introduction from the Canary Islands to Santo Domingo in 1516; but neither history nor tradition has given any intimation that cocoanuts were brought by the Spaniards from the Old World to the New. Moreover, there are several other facts which seem to preclude belief in such a transfer. The banana is supposed to have reached the Canaries from West Africa; but the cocoanut has never been found to thrive in the Canaries, nor in any part of the Mediterranean region, and it is not supposed to have existed in West Africa in the early years of the sixteenth century, but is believed to have been carried thither, subsequently, from America. It is also well known that the papal division of the "Indies" between the Portuguese and the Spanish gave the latter no access to the Indian Ocean by way of the Cape of Good Hope. Thus it would seem that if the Spaniards learned about cocoanuts, and obtained them to plant in their new possessions, it must have been from their Portuguese rivals. Such an event is highly improbable, and if it had occurred would doubtless have been made a subject of historical record and comment.

But even though arrangements might have been made for securing nuts in this manner, it would have been very difficult or impossible to keep them alive long enough to survive the voyage from the East Indies to the West. In spite of its size the cocoanut is a rather delicate and short-lived seed, and it is very improbable that at that time any Europeans had the knowledge and skill necessary to select the nuts and give them proper care on the journey.

If the cocoanut had been established in America in spite of these difficulties, it could only have been because somebody placed a high value upon it. The success of the effort would have been a matter of much self-congratulation by the Spaniards, and would scarcely have escaped record by some of the numerous early chroniclers of New Spain, several of whom show a lively interest in recounting the importation of European plants. To judge from their reports to their sovereigns, the early agents of the Spanish crown in America would have lost no opportunity of realizing full value for any special service of this kind.

Pickering was apparently the originator¹ of the statement, repeated in other compilations, that cocoanuts "were seen by Columbus on his fourth voyage, in Central America." Unfortunately, it seems to be impossible to verify this interesting information. A careful reading of the Churchill version of the life of Columbus by his son Ferdinand, which is indicated by Pickering as the authority for his statement, fails to reveal any direct indication of the cocoanut. Although the existence of seven kinds of palms is noted, they are not described in

¹Chronological History of Plants, p. 428 (1879).

detail; although "coco-nuts" are mentioned, the context shows that they were the seeds of *Theobroma*, and not of *Cocos*; and although wine is said to have been made from the juice squeezed from the pith of a palm, the tree is described as having "such prickles on the trunk as the thorn." It may have been *Acrocomia vinifera*, but certainly was not the cocoa palm.

But these references to palms are suggestive as showing the extent of interest taken in the subject during the lifetime of Columbus, and they thus afford further proof, if any were needed, against a very early introduction by way of Spain. Moreover, unless Columbus himself brought over the cocoanut, it is extremely improbable that an introduction by the Spaniards could have been made early enough to have deceived Oviedo, Cieza de Leon, and Acosta, even if we admit, for the sake of argument, the most incredible diligence on the part of the natives in disseminating the species. Under exceptionally favorable conditions the cocoanut may begin bearing in five or six years, though often it does not till considerably later, and the first nuts are usually small and infertile. Ten or fifteen years generally elapse before the tree reaches effective maturity, so that it becomes doubtful whether even the cocoanut palms which Acosta saw at San Juan de Puerto Rico were the result of European planting at that place, since, if introduced by the Spaniards, the trees would have been comparatively young and still the objects of curiosity and remark. The facts of their history would still have been fresh in the minds of living men and of exactly the nature to be told to a visitor interested in natural objects and plant introduction.

And behind these improbabilities is a more fundamental reason for disbelief in any such extended efforts at introduction by the early Spanish explorers, namely, the fact that the cocoanut is of no very considerable importance in continental regions, or even in large islands. It is only on the coral reefs and atolls of the Pacific, where there are often no other means of securing fresh water, that the cocoanut is of really vital importance. Elsewhere it is a luxury rather than a necessity, as far as the question of food is concerned, although its secondary uses are in many places very numerous and highly differentiated, so that it is now well-nigh indispensable to some millions of the human species. But in America and Africa, at least, the cocoanut is not a product of primary value, except in communities dependent upon its sale as a commercial product. There are other woods much easier to work, other fibers much easier to extract, and other calabashes¹ much easier to cut and otherwise more suitable for drinking

¹ In the West Indies, Mexico, and Central America the so-called "calabash trees," species of *Crescentia*, furnish hard-shelled fruits readily available for domestic purposes, while the ancient Peruvians cultivated the bottle gourd (*Lagenaria*) on a large scale. Moreover, pottery was manufactured all the way from Mexico to Peru and elsewhere in tropical America.

cups and culinary utensils. The earlier Spaniards were quite unacquainted with the part of the world where the cocoanut is of conspicuous importance as an economic plant, and it is simply an anachronism to predicate in them any special zeal or anxiety to provide their West Indian possessions with this palm. The accounts given by many early writers on the Tropics show that it was unappreciated as a fruit by the explorers, whose quest was primarily for gold and spices, not for objects of no recognized value in Europe. Such were often taken home to exhibit as curiosities, but this would not be a sufficient reason for international efforts at extending the distribution of such a product.

THE COCOA PALM IN ANCIENT AMERICA.

EARLY SPANISH ACCOUNTS.

But if the probabilities are all against an early introduction of the cocoa palm by the Spaniards, what may be termed the historical evidence for the prehistoric existence of the cocoanut in tropical America is more than adequate; for although none of the early writers affords a direct statement that the cocoanut was here before Columbus, this oversight can be understood by reflecting that nobody raised the question until some generations afterwards.

Oviedo, contemporary and friend of Christopher and Diego Columbus, visited the Isthmus of Panama in 1515, two years after the discovery of the Pacific Ocean. From 1520 to 1523 he was again in Colombia and the West Indies and published the summary of his "Natural History of the Indies" in 1526, after which he spent many years in America as a high official of the Spanish crown, continually adding to his monumental history, the manuscripts of which furnished materials for numerous other writers, but did not themselves reach the press until 1851. Oviedo's account of American palms occupies 5 quarto pages, about half of this space being given up to a thorough and circumstantial description of the appearance, structure, qualities, and uses of the cocoa palm and its fruit.

These palms or cocos are tall, and there are many of them on the coast of the Southern Ocean, in the province of the cacique Chiman, and many in that which they call Borica, and many more than in both places in an island of the southern gulf which is in the ocean, 100 leagues or more from the coast of Peru.

After I wrote the account which I have mentioned (1526) I was in the province and point of Borica [Costa Rica] and ate some of these cocos and carried many along to Nicaragua, and I loathed them, and others did and said the same. In fact, it is a food for men who work, and the very strong, and for others a little of this fruit is enough, for eaten continuously as was there done is not for all stomachs.¹

Nor is it easy to understand how the direct testimony of even one such writer as Acosta should have been set aside. That historian spent

¹ *Historia General y Natural de las Indias*, vol. 1, p. 335 (Madrid, 1851).

seventeen years in America—from 1570 to 1587—and had extensive personal acquaintance with Panama, Peru, and Mexico. His numerous histories and theological works were mostly written in a Jesuit monastery on the shores of Lake Titicaca, and he had the opportunity of drawing for information upon the numerous and intelligent members of this order, several others of whom wrote contemporary histories of American countries, though seldom exhibiting Acosta's wide interest in nature.

It were not possible to reckon all the fruites and trees at the Indies, for that I remember not many, and there are many more whereof I have no knowledge; and in my opinion, it were troublesome to speake of all those I now remember . . . yet do I not thinke it good to passe away under silence the Cocos or Indian palmes, by reason of a very notable propertie it hath. I call them palmes, not properly, or that it bears dates, but that they are trees like to other palmes. They are high and strong, and the higher they grow the broader they stretch out their branches. These Cocos yield a fruit which they likewise call Cocos, whereof they commonly make vesselles to drinke in, and some they say have a vertue against poison, and to cure the paine in the side. The nutte and meate being dried, is good to eate, and comes neare in taste to greene chestnattes. When the Coco is tender upon the tree, the substance within it is, as it were, milke, which they drink for daintines, and to refresh them in time of heate. I have seene of these trees in San Juan de Puerto Rico, and other parts of the Indies, and they report a wonderful thing, that every moneth or Moone, this tree casts forth a new branch of this Cocos; so as it yeeldes fruite twelve times in the yeere, as it is writte in the Apocalips: and in truth this seems like unto it, for that all the branches are of different ages, some beginning, others being ripe and some half ripe. These Cocos are commonly of the forme and bignes of a small melon.¹

Acosta later devotes a special chapter to the plants introduced to America by the Spaniards, and thus we have both direct and indirect evidence that the idea that the Spaniards brought the cocoanut was not rife in his day. Cieza de Leon, who traveled in South America between 1532 and 1550, and who wrote the first sailing directions for the Pacific coast, mentions an "island of Palms" off the coast of Colombia, near Buenaventura.

Thence the coast trends S. $\frac{1}{4}$ E. to Cape Corrientes, and following the same course vessels arrive at the island of Palms, so called from the quantities of those trees which grow on it. It is little more than a league and a half around. It has rivers of fresh water, and used to be inhabited. This island is 25 leagues from Cape Corrientes, in $4\frac{3}{4}^{\circ}$.²

Oviedo also describes the port of Buenaventura as 5 leagues from the "isla de Palmas," and it is evidently the same island to which Dampier refers in his account of the same coast.

From Cape Corrientes to the great river of Bonaventura is twenty-three leagues. In the midway is the Island Palmas, which is a small, woody island, and hath a sand on the southeast side, stretching from one end of the island to the other.³

¹ Acosta, *Natural and Moral History of the Indies*, Hakluyt ed., pp. 252, 253. (London, 1880.)

² *Travels of Cieza de Leon, 1532-1550*, Hakluyt ed., p. 20 (1864).

³ Dampier's *Voyage* (London, 1729).

But this is not the modern Cocos Island, as De Candolle seems to have supposed:

The navigators Dampier and Vancouver found it at the beginning of the seventeenth century, forming woods in the islands near Panama—not on the mainland—and in the Isle of Cocos, situated at 300 miles from the continent in the Pacific. At that time these islands were uninhabited.¹

Indeed, with the above passage in view, it is difficult to believe that De Candolle had a personal acquaintance with Dampier's 'Voyages,' since in two places it distinctly says that that worthy did not visit Cocos Island, though making a large number of references to the cocoanut palm and the banana as occurring on the American mainland all the way from Ecuador to Mexico, not only about the Spanish settlements but among the wild tribes of the Colombian coast, with whom he obtained friendship because of the common enmity to the Spaniards. Like Oviedo nearly two centuries before, he found Point Burica, the southern extremity of Costa Rica, "full of coco-nut-trees."²

Francisco Hernandez also wrote, in the sixteenth century, what still remains the largest contribution to Mexican botany. He describes and figures the cocoanut among the western Indies (*occidentales Indos*), but his account was evidently derived largely from travelers who had visited the Philippines, and as Hernandez also states that the tree did not occur in "New Spain" he has been quoted in proof of the non-existence of the cocoanut in America in pre-Spanish times, an inference which will receive attention in connection with the American names of the cocoanut.

The mistake regarding the statements of Hernandez has, however, served a useful purpose in calling forth from Velasco a definite statement regarding the pre-Spanish existence of the species in America. This assertion was fully credited by the botanist Spruce, the most recent and careful student of South American palms.

It is curious that, of the early Spanish writers on the natural history of the New World, those who knew only the eastern side of the continent, the West Indian Islands, and Mexico, such as Hernandez and Oviedo,³ assert that the coco palm was introduced into America by the Spanish settlers, while those who were familiar with the Pacific coast, including some of the earliest travelers in Peru, such as Cieza de Leon, say positively that it was already found growing on that coast, especially in the equatorial regions, when the Spaniards first arrived there. It is possible that all spoke truly according to their knowledge, and that, although this plant may be indigenous only to the islands of the Pacific Ocean, it had really reached the western coast of America, either by accident or by design, long before the advent of the white man.

¹Origin of Cultivated Plants, London, p. 431 (1886).

²Dampier's Voyages, London, vol. 4, p. 90 (1729).

³Spruce, Journ. Linn. Soc. London, vol. 11, p. 80 (1871). As neither Hernandez nor Oviedo refers to any such introduction, it would seem that this statement, like many others regarding the cocoanut, must be taken as a result of the failure to consult original authors.

Velasco, in his eagerness to vindicate his country's claim to the "Hatun-Chonta," or great palm, as the Indians call it, gets very angry with those who dispute it. "One may see," he says, "with what levity some authors relate a thousand falsehoods like Francisco Hernandez, a native of Mexico, who in his Latin history asserts that cocos were transplanted from the East to the West Indies by the Spaniards; whereas on their first arrival they found cocos laden with fruit, which is never seen on stems less than from 16 to 20 years old."

INTRODUCTION TO ATLANTIC COASTS.

The theory of the Spanish introduction of the cocoanut to America has been supported by references to Sloane, Martius, Piso, Marcgraf, and others, who give more or less distinct testimony to the effect that the Spaniards and Portuguese introduced it into Jamaica, Guiana, Brazil, and West Africa. But no discredit to these witnesses is implied in the supposition that the cocoanuts were not brought from Spain, where there were none, but from the American continent, where we have such excellent reasons for believing that there were many. The numerous Spanish expeditions to Mexico, Central America, and Peru were accustomed to make long visits for refitting their ships, both going and coming, at Santo Domingo and Jamaica. What would be more natural than that the early colonists would secure cocoanuts in this way, as well as cacao and other plants which they had from the American mainland?

AMERICAN NAMES OF THE COCOANUT.

The origin of the name *cocout* or *coco*, as the earlier writers used it, seems to have remained quite as obscure as that of the tree itself. Oviedo refers to the fruit of several species of palms as "cocos," and seems to have been the first to record the fanciful idea that that word was applied to the cocoanut because the three foramina or "eyes" suggest the grimace of monkey, a notion which Hernandez and many subsequent writers have ascribed to the Portuguese, and some lexicographers have derived *coco* from a Portuguese name for monkey, *matéco* or *matécoco*. Others have thought to trace it to the Greek *κοῦκι* (*kouki*), and even to an ancient Egyptian word *kuku*, which was formerly thought to apply to the cocoanut; and although Seeman furnished in 1868 excellent reasons for believing that at least the Egyptian reference does not apply to the cocoanut, but to *Borassus aethiopum*,¹ the Egyptian theory is still repeated in the latest editions of our most popular dictionaries. Nor did anybody attempt to show that either Hernandez, Acosta, or any of their contemporaries was acquainted with either the Greek or the Egyptian words, or that they were familiar with the cocoanut before coming to America. Hernan-

¹ Flora Vitiensis, pp. 275-278. *Borassus aethiopum* stands in the *Index Kewensis* as a synonym of *B. flabellifer* of the East Indies. Drude admits (Engler and Prantl, *Natürlichen Pflanzenfamilien*) but one species of *Borassus*, distributed in cultivation from Senegambia to Ceylon, Hindustan, and the Sunda Islands.

dez refers, whether correctly or not, to Strabo,¹ which indicates that he would not have avoided mention of any other Greek writers, while Acosta prefaces his discussion of the cocoanut by the following remark:

And it is an admirable thing to see so many different formes, tastes, and effects unknowne, whereof we did never hear speake before the discoverie of the Indies. And whereof Plinie himselfe, Dioscorides and Theophrastus (yea, the most curious), had no knowledge, notwithstanding all their search and dilligence.

Moreover, it seems probable that the word coco as a lineal descendant from the Latin *coccus* was in use among the Spaniards in its original sense of a seed, nut, or fruit, and the seeds of *Cocculus* or India berries are still called in Spanish *cocas de Levante* in much the same way as Hernandez referred to cochineal as "Cocco Indico." Both Oviedo and Acosta used the word in a wide generic sense for the seeds of several palms, and it is still applied to the seeds of smaller palms which much resemble those of *Cocculus* and are strung for rosaries. Acosta also refers to the seeds of a palm of Chili (Jubaea) as *coquillos* (modern *coquitos*), and describes the large fruits of *Bertholletia* (Brazil nut) or other *Lecythidaceae* as "another kinde of cocos" containing almonds. We have thus apparently another case like those of *Mimosa* and *Cereus*,² where ordinary Spanish words adopted into botanical nomenclature have been tortured at great length to fit the most improbable theories of classical Latin, Greek, or even more ancient derivations. But though already possessed by the Spaniards, the word coco was by no means new to America. Eighteen of the names of plants in the "Historia" of Hernandez begin with *coco* and twenty-eight with *caca*, which seem to have been used interchangeably. Thus Dampier and Cockburn frequently refer to cacao (*Theobroma*) as "coco," "coco-nuts," and "cocoa." The difficulty which we still have in attempting to restrict *cacao* to *Theobroma*, *coca* to *Erythroxylon*, *cocoa* to *Cocos*, and *coco* to *Colocasia* may be but a legacy from the popularity of these syllables in the plant names of American aboriginal tribes. However curious such a coincidence between the Spanish and American word *coco* may seem to us, it appears to have produced no such effect upon Hernandez, even when explaining the name of the plant *cocoyatic*³ on the ground that the leaves were similar to those of palms, and, although not

¹ Hernandez's chapter on the cocoanut opens with the following caption and first sentence:

"*De Nucis Indicae, et Cocci vocati arbore.* Nux Indica, quam vulgus Indorum *Maron*, Strabo vero (ut quida volut) *Palnam* vocat, a Mexicensibus *Coyolli*, a Lusitanis ob oculos quosdam *Cercopitheci* similes *Coccum*, a vulgo vero *Persarum*, et *Arabum* nuncupatur *Harel*."

² "Los cardones que los criptianos llaman cirios . . ." Oviedo, vol. 1, p. 311.

³ "*Cocoyatic, seu herba Palmae simili.*—The herb *cocoyatic*, which the people of Michoacan call *Xahuique*, has the leaves of *Porrum* or of a small palm, whence the name." "*Nova Plantarum, Animalium et mineralium Mexicanorum.*" Hernandez, p. 144 (Romae, 1651).

noted by Hernandez, this remarkable suggestion seems to receive support from the fact that the *cocobut* plant has large spherical swellings near the roots.

The statement of Hernandez, already quoted, that the Mexicans called the cocoanut "*coyolli*" is turned by De Candolle into an argument against an American origin on the ground that the word *coyolli* "does not seem to be native," though no attempt is made to indicate whence it was introduced; nor is the implication of an extra-American word met by the theory of maritime distribution. Yet if *coyolli* was not an Aztec word it either did not come alone or it fell into very friendly society with dozens of others, like *amolli*, *ylli*, *coyopatli*, *cocotzin*, *chilli*, *quilamolli*, *copalli*, and *atolli*. But a different objection may be taken to *coyolli* as an Aztec name for the cocoanut. It is well known that the Aztecs came from the temperate plateau of Mexico and that their power had rather recently been extended to the tropical coast regions.

It seems probable from the descriptions and figures of Hernandez that the *coyolli* was a native Mexican palm, probably *Acrocomia*, the fruit of which has the outer layer edible, oily, and yellow, so that Hernandez supposed it to be the same as the *Areca* or betel palm of the Philippine Islands, which is not known to have any similar name in the Eastern Hemisphere, while *coyolli* is still current in southern Mexico and Guatemala for *Acrocomia mexicana*. Although declaring that the Mexicans (Aztecs) called the cocoanut "*coyolli*," Hernandez distinctly says that he never saw any of the trees in New Spain. This, however, is not necessarily a discrepancy or an indication that Hernandez thought that the palm had been introduced by the Spaniards, since "*Nova Hispania*" was used by some of the early writers in a rather narrow sense for the Aztec¹ region of Mexico, and not for that country as defined by its modern boundaries. But before this Hernandez had already said that the cocoa palm was generally distributed in the East and West Indies, and especially in maritime and sandy places about human habitations. He secured from travelers accounts of many Philippine plants and their uses, which seem to have been largely drawn upon in the present instance. But it must not be forgotten that even in his time the "Indies" were still one-quarter of the world, for as Acosta quaintly says:

. . . Wee meane by the Indies those rich countries which are farre off and strange unto.us. So we Spaniards do indifferently call Indies the countries of Peru, Mexico, China, Malaca, and Bresil; and from what parts soever of these any letters come, wee say they bee from the Indies, which countries be farre distant and different one from another.

¹ According to Humboldt the Kingdom of Montezuma occupied only one-eighth of the territory of modern Mexico. Political Essay on the Kingdom of New Spain, vol. 1, p. 68 (New York, 1811).

Our modern curiosity as to how the cocoanut and other plants crossed the Pacific had not yet developed. Hernandez learned about the Philippine plants by questioning travelers who were going and coming across Mexico, but this was a matter far different from the introduction of the Philippine palms to use and culture in Mexico, which with three more centuries of improved opportunity has not yet taken place. Chocolate was certainly a far more important article to the Spaniards than the cocoanut, and yet the cacao tree is believed not to have been introduced from Mexico to the Philippines until after 1660, a century later than Hernandez's visit; and Humboldt believed that *Citrus trifoliata* was the only Asiatic species which had become established in Mexico.¹ This would seem to render improbable any very extensive introductions of tropical plants at an earlier date, and is a strong reminder that notwithstanding its obvious importance the introduction of useful plants is a subject still generally neglected in the agriculture of the most advanced countries, and even in dealing with plants which can be grown from seed of indefinite vitality instead of with the delicate and short-lived germs of tropical species.

But to return to Hernandez. We find in the sentence already quoted² the name *maron* ascribed to the "vulgus Indorum," or ordinary Indians, as distinguished from the "Mexicensibus," a fact which seems to have been entirely overlooked by De Candolle, who, after dismissing *coyolli*, leaves us with the implication that no genuine American name for the cocoanut was known. Possibly he supposed this word to pertain to the East Indies, as does much of the essay of Hernandez. Such, however, is not the case. Nothing resembling *maron* appears in the extensive lists of Polynesian, Malayan, and Asiatic names, but it was reported by Heller, in 1853, as apparently still in use in southern Mexico.

But etymological arguments based on old records are often of little use except as literary confirmations of facts already ascertained by more reliable evidence. Thus, the cocoa question might be carried another stage around the world when we read, in Pigafetta's account of the voyage of Magellan, that among the native products offered by the people of the Philippine island of Samar that "one which they call *cochi* is the fruit which the palm trees bear." But as no subsequent traveler has recorded such a name in that quarter of the globe, we may reflect that Pigafetta was an Italian among Spaniards and Portuguese sailors, some of whom had previously visited the "Indies," and that he did not show a philologist's caution in studying the forms and origins of words.

Although, as indicated above, the cocoanut is supposed to have been

¹ Loc. cit., vol. 2, p. 365.

² P. 267, footnote.

introduced into Brazil by the Portuguese, Nieuhoff recorded a native name for it in 1647.

There also grow coco trees in Brasil, called by the natives inajaguacuiba, and the fruit inajaguacu.¹

But, as Nieuhoff had already explained that the fruit of the pindava palm (*Maximiliana*?) was called *inajamira*, meaning "small cocoanut," we may be dealing, as in the case of *coyolli*, with a recently extended use of some native word or combination misinterpreted by Nieuhoff.

THE COCOA PALM AN AMERICAN SPECIES.

BOTANICAL EVIDENCE.

If the historical evidence is ample for the establishment of the existence of the cocoanut in America before the advent of Europeans, the botanical evidence is no less conclusive to the effect that it had been there a long time. In other words, it is a member of the American and not of the Asiatic flora, though the reasons for this belief have been very inadequately appreciated. Thus, De Candolle noted the existence of eleven other American species of *Cocos* as one of the arguments for the American origin of *C. nucifera*, though this fact appeared to be outweighed by others indicating an Asiatic nativity. It is not, however, a matter of eleven or more species of *Cocos*, but of the whole family *Cocaceae*, consisting of about 20 genera and 200 species, all strictly American with the single exception of the rather aberrant African oil palm (*Elaeis guineensis*), which has, however, an American relative referred to the same genus. Several fossil palms from western Europe are supposed to belong to this group, but the cocoanut is the sole² representative which has been connected with Asia and the Malay region, though no reason has ever been advanced to show why the other members of the group could not have established themselves and maintained an existence under Malayan conditions, which are in every way adapted to palms, and which support hundreds of indigenous species belonging to other families of the group. Nor do we any longer take refuge in a suggestion formerly used in dealing with difficult cases of geographical distribution, and argue that the cocoanut and the banana were such desirable fruits that they were separately created or bestowed upon the inhabitants of both hemispheres. The theory of the independent development of the same species, however, is still occasionally drawn upon, and may have a certain propriety in dealing with the phylogeny of groups which have undergone a parallel development. Thus, if other species of *Cocos*, or closely allied genera, existed in the tropics of the eastern hemisphere, we might not

¹ Churchill's Travels, vol. 2, p. 134 (1732).

² *Cocos mammillaris* Blanco, from the Philippines, is based on one of the numerous Malayan culture varieties of *C. nucifera*.

be confident regarding the affinities of a type so different from its congeners as is the cocoanut.¹ But with no oriental relatives in even generic range there is no rational basis for doubt that the species belongs to an American series.

Under an evolutionary conception of nature we must believe that economic species like all others originated in definite areas, and that they have been domesticated at definite periods and distributed by natural means. There may, of course, have been independent discoveries of the usefulness of well-developed and already desirable fruits, and many such fruits have remained in the Tropics comparatively little affected by cultural selection. Of this, the several species of *Anona* furnish good examples. The sour-sop, the sweet-sop, and the custard apple are American fruits which probably reached in their wild state something near their present degree of excellence. Although now widely distributed throughout the Tropics, they are usually planted in a rather desultory manner and do not receive the same amount or kind of attention bestowed upon staple food plants or commercial products. As already remarked, the cocoanut as a fruit is of primary importance only in the coral islands of the Pacific, where the number of economic plants is limited, and where even fresh water is sometimes wanting, and only the milk of the cocoanut makes human life possible. In America the relative value of the cocoanut places it in the list with such natural products as the *Anonas*, with which it agrees in offering little differentiation of varieties.

PREHISTORIC INTRODUCTION OF OTHER PLANTS.

A wild product of secondary value may not receive careful attention until quite late in the history of an agricultural people; but, on the other hand, it is impossible to agree with Dr. Watt² that such staple food plants as the yams were "cultivated at a much later date than most other vegetables, probably on account of the fact that without the trouble of cultivation they afforded an unfailing supply of food." This theory is altogether too ingenious. Primitive peoples are not likely to have undertaken to cultivate anything the utility of which had not been adequately demonstrated, and it is exactly with such plants as *Dioscorea* and *Pachyrhizus* that the beginnings of primitive agriculture might be expected.³ Watt's theory, however, is of much

¹ In reality *Cocos* should be treated as a monotypic genus to contain only *C. nucifera*. The remaining species also are not a natural assemblage and should be separated into several generic groups.

² Dictionary of the Economic Products of India, vol. 3, p. 120.

³ Seeman has noted (*Botany of the Herald*, p. 73) that, with the exception of the potato (*Solanum*), the root crops cultivated on the Isthmus of Panama, the yam (*Dioscorea alata*), yuca (*Manihot*), camote (*Batatas*), and otò (*Colocasia*), are all propagated by cuttings of great vitality, which "may be left for weeks in the field, exposed to sun and rain, without receiving any injury."

interest because it was intended to explain the probability that the yam was not in use in Sanscrit times, or at least had no distinctive name. In China, as in the Malay region, Polynesia, and America, yams appear to have been among the earliest, as they are still the most important, of cultivated root crops. The Chinese yam (*Dioscorea batatas*) never penetrated India, has never been reported in the wild condition, and was probably not a native of the Asiatic continent. Several other species cultivated in India and neighboring regions are also not known in the wild state, and presumably came from farther east. The probability that *Dioscorea alata*, at least, was carried westward by the primitive race which transported the cocoanut is very great, and is supported by the fact that the yam bean (*Pachyrhizus*), a leguminous plant with a large yam-like root, and of even more highly probable American origin, was introduced in prehistoric times and is still sparingly cultivated in India. In Polynesia the use of *Pachyrhizus* in religious ceremonies seems to indicate former cultivation, but what is still more interesting, the Polynesians, like the aborigines of America, had knowledge anticipating the modern discovery of the fertilizing value of leguminous crops, and encouraged the growth of *Pachyrhizus* in their fallow clearings in order to render the land more quickly able to yield good crops of yams.¹

The sweet potato furnishes another instance of the trans-Pacific distribution of a useful plant in prehistoric times, though it may have come into use later or traveled less rapidly than the cocoanut. In the equatorial belt the sweet potato was doubtless, as it still is, a much less important crop than the yam, but among the subtropical Hawaiians and Maoris it is believed to have been the principal food plant. As with the cocoanut, the sweet potato was designated by cognate names throughout the entire Pacific region, and, moreover, it affords a philological argument wanting with the cocoanut, since the Polynesian names *umara*, *kumara*,² and *gumara*, are apparently represented on the continent of America by the word *cumar*, in the language of the Indians of Ecuador. The Mexican name "camote," supposed to have been transferred to the Philippines in Spanish times, may also be derived from the same linguistic root. Like the banana, the sweet potato has become seedless through long cultivation and propagation exclusively from cuttings. The theory of distribution by ocean currents has here no standing; but the botanical evidence of American origin is not nearly as strong as in the case of the cocoanut, since many other species of the same and related genera are very widely spread through the Tropics. Rutland and others have drawn from the names and dis-

¹ Engler's Bot. Jahrb., vol. 25, p. 640 (1898).

² In addition to this name the people of one of the Viti Islands have a term which means "foreign yam," a possible indication of an arrival subsequent to that of the yam.

tribution of the sweet potato arguments for Polynesian contributions to prehistoric America; but if the present interpretation of the history of the cocoanut be accepted it will afford additional support for the opinion shared by De Candolle that the sweet potato is of American origin and was carried by man from east to west. But, without attempting here an exhaustive discussion of the nativity and history of either the sweet potato or the banana, it is sufficient to reiterate that the existence of these two seedless plants on both sides of the Pacific in prehistoric times goes far to demonstrate former human communication by means of more extensive land masses or, through greater nautical skill, across seas commonly deemed impassable to primitive man.

THE DISSEMINATION OF THE COCOA PALM.

At the present time the cocoa palm is to be found on nearly all tropical coasts, though there are still many hundreds of miles of shore line in Africa and Australia not yet adorned by this magnificent plant. Of the few subtropical countries, where the species has been grown successfully, southern Florida is perhaps the most important; for while the tree is able to thrive in a great variety of soils, and even in pits dug in solid limestone, it is apparently very susceptible to injury from extremes of temperature, and is incapable of being naturalized in regions subject even to moderate cold, or in those where great heat must be endured. But, like many other palms, it will, if planted, vegetate for many years in situations where fertile seeds are never matured.

Being thus strictly limited to the Tropics the habits and conditions of growth of the cocoa palm have received comparatively little attention from the botanical writers of temperate regions. Although, as already indicated, it is probable that the cocoa palm was not disseminated in the Atlantic Ocean until after the Spanish discovery of America, its rapid extension in the Western Hemisphere, together with the fact that it was found to be so widely spread in the East, seem to have been taken as indications that its distribution has been extended by natural causes. But while it evidently existed much earlier in the East Indies, there is some ground for the opinion that its arrival in Asia was comparatively recent, or subsequent to the development of a considerable degree of civilization in the countries bordering on the Indian Ocean; and even in Mohammedan times there is said to have existed a brotherhood devoted to the dissemination of the cocoanut among the islands of this region. In Ceylon there is an extensive and well-preserved tradition¹ implying a rather late introduction of

¹Seeman's Popular History of the Palms, p. 146 (London, 1856).

the cocoanut. Many of the details are fanciful, but Seeman, who gave the matter thorough study, was inclined to credit the principal points.

The littoral parts of Ceylon are now densely covered with this tree, and it looks more at home there than I have ever seen it in any part of the world. Yet both tradition and history affirm that at one time the cocoanut was unknown in Ceylon. Not far from Point de Galle there is carved on a rock the gigantic effigy of a native prince, Kottah Rayah, to whom is ascribed the discovery of the properties of the cocoanut, which before his time were unknown, as was also the tree. Moreover, the oldest chronicle of Ceylon, the "Marawansa," the historical value of which is now fully admitted, is absolutely silent about everything relating to the cocoanut, whilst it never fails to record, with tedious minuteness, every accession of other fruit trees made to the plantations by native princes. Now, is it probable that a fruit like the cocoanut, which is often tossed about the ocean for months without losing its germinating power from the effects of salt water—is it probable that if such a fruit had been indigenous to any part of Asia, it should have reached Ceylon only in a comparatively recent historical period?¹

From the limited distribution of the cocoanut and other tropical products St. Pierre deduced a confirmation of the formerly accepted brevity of the earth's history, and while we can not make use of the argument for its original purpose, it may still be recommended to the attention of those who believe in an Asiatic origin and an aquatic distribution.

I am persuaded, at the same time, that the greatest part of flitting plants must have a principal center, such as a steeprock, or an island in the midst of the sea, from whence they diffuse themselves over the rest of the world. This leads me to deduce, what I consider an irrefragable argument in support of the recent creation of our globe; it is this, were the globe of very remote antiquity, all the possible combinations of the propagation of plants by seed would have been already completed all over the world. Thus, for example, there would not be an uninhabited island and shore of the seas of India, which you would not find planted with cocoa trees, and sown with cocoanuts, which the ocean wafts thither every year, and which it scatters alternately on their strands by means of the variety of its monsoons and of its currents. Now, it is unquestionably certain, that the radiations of that tree and its fruit, the principal focusses of which are in the Maldivia Islands, are not hitherto diffused over all the islands of the Indian Ocean . . . There are, in like manner, a multitude of other fruits between the Tropics, of which the primordial stocks are in the Mollucas, in the Philippines, in the islands of the South Sea, and which are entirely unknown on the coasts of both continents . . . I shall pursue this reflection no farther; but it evidently demonstrates the newness of the world. Were it eternal, and exempted from the care of a Providence, its vegetables would long since have undergone all the possible combinations of the chance which resows them. We should find their different species in every situation where it was possible for them to grow.

It may be that neither the evidence adduced by Seeman nor the quaint deductions of St. Pierre can be considered to have important bearing upon the question, but their views are of interest because the inferences they suggest are in accord with so many other considerations tending to prove an extra-Asiatic origin for the cocoanut.

¹ Flora Vitiensis, p. 276.

ORIGIN OF THE VARIETIES OF THE COCOANUT.

The multitudinous uses and universal popularity of the cocoanut on the shores and islands of the Indian Ocean and in the Malay region generally have been interpreted by DeCandolle, Seeman, and others as an indication of an Old World origin. If, however, the late appearance of the cocoanut in Ceylon be taken into consideration, it becomes apparent that the theory of an Asiatic origin is incompatible with that of distribution by ocean currents; for, if the maritime theory is to be upheld, origin at a great distance must be predicated in order to explain a comparatively recent arrival and a formerly more limited distribution in the Indian Ocean. And yet this concession does not greatly improve the situation, since we have excellent ground for believing that the cocoanut has existed for several millenniums in the islands to the southeast of Asia, or long enough to permit an extensive differentiation of varieties.

As with our temperate fruits, the varieties of the cocoanut differ greatly in size, color, shape, and quality, and the trees also have varietal peculiarities. In one sort the divisions of the leaves are only imperfectly separated, a condition appearing in some of the more primitive relatives of the cocoanut. Some of the varieties appear to have been selected for special qualities, such as the flavor of the flesh, oil, or milk, or the abundance and ease of extraction of the fiber.

In America the relatively small importance of the cocoanut has not secured for it the attention necessary to the recognition of differences between the fruits of individual trees and the consequent development of varieties by human selection, but in the Malay region more than fifty sorts are reported, with distinct names and characteristics. Varietal differentiation in a plant like the cocoanut may be expected to require much more time than with annual species, probably at least ten times as long. Moreover, if it be denied that the cocoanut varieties arose entirely through an active process of artificial selection, on the ground that considerable differences must have been attained before they would have been appreciated and utilized, the time requirement is still further increased. But in any case the varieties were doubtless local at first, and their differentiation was probably favored by isolation in accordance with the general tendency among the palms to form series of similar species of limited distribution. That this process is well advanced among the cocoanuts of the Malay region would seem to indicate their presence there for several thousand years, and this fact is apparently incompatible with the late arrival of the species in Ceylon, if the winds and currents operate with any approximation of their supposed efficiency. On the other hand, it is quite conceivable under a theory of distribution by human agency that the cocoanut might have existed for an extremely long period in the Philippines and other

groups to the southward before it was carried around the end of the Malay peninsula into the Indian Ocean. The cocoanut could probably not be carried inland into the humid Malay peninsula, and a people migrating thither from the islands would have been compelled to leave it behind on the coast.

OCEAN CURRENTS INEFFECTIVE.

Owing to its great weight and size, the cocoanut can be held to have reached Asia in only three ways—by means of a formerly different distribution of land masses, by ocean currents, or by human agency. There is little reason to carry the question far back in geologic time, because the strict localization of the genera and higher groups of palms gives no evidence of contact between the Asiatic and American floras since the differentiation of the principal groups took place. The theory of transfer by ocean currents has received much attention and far greater credence than the facts seem to warrant. While it is difficult to set a limit to the possibilities of such a means of distribution, the probabilities are certainly not extensive. To prove that the cocoanut is adapted especially for maritime distribution, it would be required to show that water is the normal, or at least a very frequent, medium of dissemination, and that on this account selection has favored the development of thicker husks. But it is obvious that few cocoanuts ever reach the water, and that the thick husk is necessary to permit the heavy fruit to drop with safety from tall trees, and, as all nuts must make this journey, such a selection is real and universal. Moreover, the protection is even yet not adequate, so that it is customary in the East Indies to pick by hand and let down by ropes the nuts intended for planting, those which are allowed to fall being injured, frequently to the extent of failing to germinate or of furnishing only weakly and debilitated seedlings which may never attain to normal development or produce full-grown, fertile fruits. Even when no mechanical injury to the nut proper is apparent, the power of germination may be destroyed by decay, which sets in where the husk has been bruised. To insure healthy and vigorous seedlings the nuts must be fully ripe, after which planting can not be safely delayed more than a month. If kept too moist the nuts rot, but if too dry they soon lose the power of germination. If allowed to lie in the sun and become overheated, they are also killed, while under too much shade the seedlings will make little or no growth.

There is, indeed, little in the way of observed fact to support the poetic theory of the cocoanut palm dropping its fruit into the sea to float away to barren islands and prepare them for human habitation. This time-honored fancy contains several other practical difficulties. Thus, in the first place, the cocoanut palm seldom grows upon the immediate strand overhanging the water, or even in reach of ordinary

waves. It is only where the shore is being undermined or through some other relatively infrequent accident that the nuts would fall into the water. It is true that accounts of floating cocoanuts are to be found in Dampier's Voyages and elsewhere, but such records show the rarity rather than the frequency of the occurrence and give us, in addition, no evidence on the viability of the seed observed. The additional facts may be cited on that side that the Hindoos have a festival in which it is customary to throw large numbers of cocoanuts into the sea, while many must be swept away from the coasts of continents and large islands by floods and swollen rivers. But it is far from correct to suppose that all nuts which reach the water are really launched for oceanic wanderings; the chances are still hundreds to one that they will be thrown back immediately upon their own coast, like other objects floating in the surf. High waves or tides, instead of floating shore débris away, merely carry it farther inland, as everybody familiar with seacoasts knows.

Then from the nuts which might reach the open sea take all except the infinitesimal number which would arrive anywhere while still alive, and reduce this by an equally great proportion which would simply be cast up to dry on the sand; reduce again for those which would be thrown back and smothered in the bushes or find unsuitable conditions of growth, and you have left still a possibility, it is true, but of a very high order of infinitesimals and utterly inadequate to accomplish the widespread distribution of the present species. Empty husks must not be counted; these sit high in the water and might easily be floated or blown off shore and would make quick journeys.¹

In *Island Life*, Wallace refers to the double cocoanut (*Lodoicea maldivica*) as furnishing a conspicuous instance of maritime distribution. In reality, however, this case proves just the contrary of what was intended; for, although double cocoanuts have been thrown up for centuries on the shores of the Maldivé Islands and of other parts of the East Indies, this transfer of nuts seems never to have resulted in the establishment of a single tree of *Lodoicea* outside the three small islands to which it is confined in the Seychelles. Until the explorations of Europeans resulted in the discovery of the palms, the East Indians had universally believed that the nuts were a marine product, on which they placed the highest value because of supposed medicinal qualities.

Shipwrecks would undoubtedly furnish the most successful method of launching viable cocoanuts, and if, as has more than once happened

¹Experiments like those of Guppy (Journ. Trans. Victoria Inst., vol. 24, p. 305, 1891) on the periods of flotation of seeds are of value, of course, only when it can be shown that the dry seeds will germinate after floating for long periods in salt water. The drier the seeds to begin with, the better they will float, but many tropical species are like the cocoanut in that their seeds when dry are dead.

in Florida, there are people on hand to plant them as they come ashore, this means of extending the distribution of the species may be very effective. In fact, there seems to be but one instance on record where living cocoanuts are known to have floated to a remote island, and even in this the possibility of shipwreck is by no means excluded, since oaken timbers were also cast up on the same island about the same time.

The philosopher Francis Leguat and his unfortunate companions, who were, in the year 1690, the first inhabitants of the small island of Rodriguez, which lies 100 leagues to the eastward of the Isle of France, found no cocoa trees in it. But precisely at the period of their short residence there the sea threw upon the coast several cocoanuts in a state of germination, as if it had been the intention of Providence to induce them, by this useful and seasonable present, to remain on that island and to cultivate it.

Francis Leguat, who was unacquainted with the relations which seeds have to the element in which they are designed to grow, was very much astonished to find that those fruits, which weighed from 5 to 6 pounds, must have performed a journey of 60 or fourscore leagues without being corrupted. He took it for granted—and he was in the right—that they came from the island of St. Brande, which is situated to the northeast of Rodriguez. Those two desert islands had not as yet, from the creation of the world, communicated to each other all their vegetables, though situated in a current of the ocean which sets in alternately, in the course of one year, for six months toward the one and six months toward the other.

However this may be, they planted those cocoanuts, which, in the space of a year and a half, sent out shoots of 4 feet in height. A blessing from Heaven so distinctly marked had not the power of detaining them in that happy island. An inconsiderate desire of procuring for themselves women constrained them to abandon it, notwithstanding the remonstrances of Leguat, and plunged them into a long series of calamities, which few of them were able to survive. For my own part I can entertain no doubt had they reposed that confidence in Providence which they had reason to do its care would have conveyed wives for them to that desert island, as it had sent to them the gift of the cocoanut.¹

But, in spite of the quaintness of the language and the piety of the argument, we must not overlook the fact that in the desert island, as in Florida, there were men on hand who knew what to do with the cocoanuts, which had hitherto been unable to establish themselves.

FAILURE OF MARITIME DISTRIBUTION IN AUSTRALIA.

History and anthropology, and the distribution of seedless cultivated plants such as the sweet potato, taro, banana, and breadfruit, testify to extensive and sustained human communications and migrations throughout the islands of the Pacific and the Malay region, so that no antecedent improbability attaches to a belief in the dissemination of the cocoanut by man. And yet those who have cherished the theory of ocean winds and currents might still insist on the efficiency of these means of dispersion were it not for the fact that the continent

¹St. Pierre's Botanical Harmony, p. 87. (Translated by Hunter, Worcester, Mass., 1797.)

of Australia presents the results of a gigantic and totally negative experiment which could scarcely have been better arranged to test the value of such a hypothesis. The colony of Queensland presents a thousand miles of tropical coast line facing eastward toward the currents which set against it from the innumerable cocoanut islands of the central and western Pacific. And yet in the latter part of the last century Moresby¹ found cocoanuts only where they had been planted at a European settlement, the beginning of a considerable industry in tropical Queensland where the natural conditions have been found very favorable for the present species. As in the time of Dampier, Moresby found cocoanuts in great abundance on the coast of New Guinea, and even on some of the islands in the narrow Torres Straits where a complication of tides, winds, and currents would give great opportunities for the interchange of floating objects. And yet neither here nor in the remaining 3,000 miles of tropical northern and western coasts has the cocoa palm been reported by travelers or explorers as growing spontaneously. Curiously enough, taro was found by Captain Cook wild in North Australia, a possible indication of attempted colonization by an agricultural people. And in view of the fact that large fleets of Malay proas from Macassar had long been accustomed to make annual voyages to the trepang fisheries of Marega, the northern coast of Australia, bringing with them rice and cocoanuts² as provisions for their visit of three or four months, it is almost

¹Moresby, *Discoveries and Surveys in New Guinea and the D'Entrecasteaux Islands*, p. 7. (London, 1876.)

"In front of Mr. Sheridan's house young cocoanut trees, planted by him as an experiment, are growing vigorously—the only ones, strange to say, to be found in North or East Australia, although they grow on Cocoanut Island, only about 20 miles off Cardwell."

Thirty miles from Cardwell Moresby rescued the remnant of a crew of Solomon Islanders from a boat which had drifted 1,800 miles from Fiji to the coast of Australia in about five weeks.

Nearly a century before the same coast had been scrutinized from a small boat by Captain Bligh and his starving companions. They found empty shells of the cocoanut on Restoration Island and also on a small reef near Sunday Island.

"Many pieces of cocoanut shells and husk were found about the shore, but we could find no cocoanut trees; neither did we see any on the main."

Strangely enough Bligh also found with the cocoanut shells signs of the accidental presence of Polynesians on the Australian coast in the form of a large canoe and an abandoned hut, structures evidently not made by the natives of Australia. (See *Bligh: A Voyage to the South Sea*, London, 1792, pp. 204, 210, 213.)

With the settlement of this coast by Europeans it has become certain that the stranding of cocoanuts is by no means a rare occurrence, and Hedley well remarks:

"But, if the popular idea were correct, the Queensland beaches should have presented many hundred miles of cocoanut groves to their earliest explorers, receiving, as I can testify they do, abundance of drifted nuts and fulfilling every requirement of soil and climate."

²Lang, *View of the Origin and Migrations of the Polynesian Nation*, p. 56 (London, 1834).

incredible that the nuts did not find their way ashore from shipwrecks, if indeed they were not commonly taken on land by those engaged in drying the trepang.

On the Queensland coast the finding of cocoanuts, and even the existence of an occasional "wild" cocoa palm, within recent years is claimed by Hedley,¹ but he agrees that even the eating of the stranded nuts by the natives is no adequate explanation of the complete failure of the species to become established on any of the shores of the continent, and if it be admitted that the absence of the cocoanut from Australia is due to its inability to maintain an existence without the continuous help of man, rather than to the lack of all accidental opportunity to reach the shores of that continent, the probability that its general distribution is the result of human agency is greatly increased. For whatever be the real nature of the difficulty, it is evident that oceanic distribution has proved radically inefficient in the only instance where the factor of fostering human care was eliminated, and this not on an insignificant island but on a continental coast line with a variety of soils and climates, and where subsequent experiment by civilized men has shown that the cocoanut will thrive abundantly.

Rutland² has already pointed out that the distribution of the cocoanut in the southern seas "exactly coincides with the extension of the art of agriculture," and he adds the pertinent though not entirely accurate observation:

. . . If the cocoanut palm was transported from Polynesia to America as a cultivated plant, it would probably be found in cultivation on that continent instead of in a wild state, the ancient inhabitants having made little use of the fruit. Throughout Polynesia the cocoanut was of the utmost importance, as many of the islands would have been uninhabitable without it. If its presence on these islands was due to cultivation, we have in it another important evidence of the colonization of the region.

HUMAN ASSISTANCE NECESSARY.

After his extended voyage among the Pacific islands Pickering³ published the following opinions combining the results of his own inquiries and the consensus of opinion of resident Europeans:

With the above exceptions, the useful plants appear to be of foreign origin. The *cocoa palm* is the principal one, and so invariably is its presence attributable to human operations that it has become a guide to the traders in seeking for natives.

Notwithstanding that the fruit is well adapted for floating uninjured over a wide expanse, I have never met with an instance of the cocoa palm having spontaneously extended itself from island to island. Two distinct varieties are recognized at the Fiji Islands.

C. nucifera throughout the Pacific occurs only on those islands to which it has been carried by the natives, a fact well known to traders; was observed by myself only under cultivation throughout the islands of the Pacific and the Malayan archipelago.

¹ Memoir III, Australian Museum, Sydney, p. 22 (1896).

² Trans. New Zealand Institute, vol. 29, p. 13 (1896).

³ Races of Men (London, 1863), and Chronological History of Plants (Boston, 1879).

Recent testimony is no less definite and emphatic:

It is to be emphasized that all cocoanuts are *planted*; the idea of a wild palm being as strange in Funafuti as that of a wild peach might be in England. Gill, in describing the primeval forest of the uninhabited island of Nassau in 1862, alludes to but one cocoanut tree among the indigenous vegetation. I doubt whether, despite popular opinion to the contrary, a wild cocoanut palm is to be found throughout the breadth of the Pacific. Certainly it is most rare, again contrary to popular theory, for a drifted cocoanut thrown upon the beach by winds and waves to produce a tree. So intimately is this palm now associated with native life that it is difficult to imagine an atoll before its introduction.¹

That the Polynesians were not accustomed to expect cocoanuts on uninhabited islands is further indicated by the existence of a myth² in which the progenitor of the inhabitants of Humphrey Island, to the northward of the Society Group, is said to have introduced the cocoa palm by planting a nut picked up at sea. The Marquesas islanders believed that the cocoanut was introduced from the eastward by one of their gods.³

To these testimonies may be added the statements of Woodford,⁴ who made a careful investigation of the conditions existing in the Solomon Group.

Many of them have small patches of cocoanut trees, a sure sign of frequent native attention, as, from repeated observations, I am convinced that cocoanut palms will rarely grow, and certainly will not bear fruit, unless attended to and kept clear of overgrowing trees.

Cocoanuts are an infallible sign of present or recent habitation. When cocoanuts are left to themselves the young trees become speedily choked by the bush that grows up round them and can consequently bear no fruit, so that, as the old trees die, there are no young ones to replace them.

In his general discussion De Candolle appears to have given considerable weight to the fact that several botanists have reported the cocoanut as growing wild in the East Indies, while only Seeman claims to have seen it in that state in America. But such reports of the finding of cultivated species in the wild state can easily be taken too seriously. There are all gradations between plants which exist only in cultivation and those which are able to escape and establish themselves with the smallest opportunity. In the Tropics the distinction between wild and cultivated often quite fades out, and especially with trees, since these are generally so much more permanent than the traces of human habitation, while at the same time the botanical collector usually has little time and less skill for finding the latter. Throughout the moist Tropics it is possible, for instance, to find wild bananas—that is, bananas growing without human assistance. And

¹ Hedley, *Memoir III*, Australian Museum, Sydney, p. 22 (1896).

² Gill, *Myth and Songs from the South Pacific*, 72 to 74, quoted by Guppy, *Journ. Trans. Victoria Inst.*, vol. 23, p. 46 (1889-90).

³ Porter's *Cruise in the Pacific Ocean*, vol. 2, p. 54 (Philadelphia, 1850).

⁴ "A Naturalist among the Head-Hunters," pp. 194, 210 (London, 1890).

yet the banana is seldom, if ever, able to establish itself as a wild plant in tropical lowlands, for the reason that wherever it will grow shrubs and trees will also thrive and choke it out in a few years. The case is much the same with the cocoanut, except that in the course of a century the signs of human agency would more effectively disappear. It is not sufficient to find cocoa palms far from existing human habitations; the question is whether the species could really maintain itself without human assistance and protection against other vegetation. Obviously this can not be determined by simple inspection, but a satisfactory experiment might require careful records carried over at least two or three generations of men and palms. The probabilities are, however, overwhelmingly against the continued independent existence of the cocoa palm at sea level anywhere in the moist Tropics. It is true that if planted by man it will grow in many places where it would never plant itself, and it might also maintain itself in places where the proper conditions were continued by human agency. In undisturbed nature, however, the extermination of the cocoanut by the encroachment of the tangled masses of vegetation which invade tropical beaches would probably require but a few centuries. This idea is recognized in the Cingalese proverb, "The cocoanut will not grow out of the sound of the sea or of human voices," and in the belief held among the same people that the trees will not thrive unless "you walk and talk amongst them."

Although the cocoa palm furnishes an extreme instance, this requirement of open ground is not peculiar to it, but is general in this entire natural order, the members of which, with the exception of the climbing genera, are unable to survive under genuine jungle or forest conditions. The large, long-leaved species are particularly at the mercy of tangled tropical vegetation, since it is impossible for them to make the rapid growth necessary to keep up with trees of other plant families. The arboreal palms are first required to produce a long succession of leaves at the level of the ground, their trunks making no upward growth until the full diameter has been reached, which seldom requires less than three years. On completely barren islands¹ seedling cocoanuts might continue to flourish, but if the space

¹ Dr. Treub has reported (Ann. Jard. Bot. Buitenzorg, vol. 7, p. 217, 1888) the finding of a cocoanut on the beach of an island formed by the eruption of Krakatoa, but no intimation is given that it had germinated or was alive.

The very small and remote Keeling Islands of the Indian Ocean offer, perhaps, the most probable instance of spontaneous occupation by the cocoa palm, but even here the assertion of the absence of human agency is limited to the denial of "permanent inhabitants" earlier than the nineteenth century. Moreover, there seems to have been but one other arboreal species (*Cordia subcordata*) which has become numerous, and this was confined to the interior of the islands, leaving the coast districts to the uncontested monopoly of the cocoanut. These islands have been studied by Darwin, Forbes, and Guppy, and the last mentions (Journ. Trans. Victoria Inst., vol. 24,

needed by the expanding leaves has been completely occupied by other trees and tangled vines the palm remains stunted and finally dies. This disability limits the palm in nature to more open situations, where unimpeded upward growth is possible through the absence of a dense covering of other vegetation. Sandy and rocky countries, exposed mountain tops and shores, the banks of rivers and smaller streams, are the favorite localities of palms. It is also of interest to note that the cocoanut is seldom or never associated with wild native palms, even in the coast regions where it is most abundant. Moreover, contrary to the statements of some writers, it does not appear that the other species of *Cocos* and allied genera show any tendency to littoral habitats. The African oil palm seems more nearly to resemble the cocoanut in this respect; but it is distinctly more tolerant of forest conditions, and in West Africa thrives in inland situations where the cocoanut fails to make even a respectable beginning. And although seldom regularly planted, the distribution of the species is obviously due in large measure to human agency. The seeds are scattered in large numbers in the open areas about native villages and farms. The young trees are spared by the natives when other vegetation is cleared away, both because of their utility and because they are difficult to cut, and they are able to resist fires which are fatal to most of the local plants. As a result oil palms are abundant in localities where the native populations are sedentary and large enough to require frequent clearing of the land for agricultural purposes, but rare or entirely wanting where the natives move about or are so few as to permit the renewal of forest conditions between the periods of agricultural use of the land. But the oil palm, with its much smaller and less delicate seed, has almost infinitely greater possibilities of maintaining an independent existence than the cocoanut, which, with over three centuries of opportunity, is not showing any remarked tendency to make a spontaneous extension of its range in West Africa.

In fact, among all its relatives the cocoa palm seems to be peculiarly ill adapted to maintain an existence at low elevations in the Tropics. Young trees have comparatively few leaves, and these are large and open and do not effectively shade and occupy the ground like the large and densely packed leaf crowns of *Elaeis* or *Acrocomia*. The latter palm is able to increase in the pasture lands of Porto Rico because of the protection afforded by its large needle-like spines, while the young

p. 290, 1890-91) numerous widely distributed littoral species which had not yet become established on the island, although viable seeds were frequently cast up by the sea. The inference, accordingly, seems warranted that the vegetation of these islands is of relatively very recent origin, and that the cocoa palm was able to flourish because it arrived in advance of the species which otherwise might prevent its becoming established.

tops of the cocoanut are not only unprotected, but are apparently relished by cattle, against which nurseries and young plantations must be fenced

The presence of the cocoa palm only about actual human habitations and its complete absence from the forests of Guatemala is brought forward by Stoll¹ as a reason for denying the existence of the species among the Indians by whom many of the now wooded areas were formerly thickly populated. It is evident, however, from what has already been said that such an inference is quite unwarranted. Whatever might be the possibilities of the cocoanut if cast up on a newly emerged volcanic or coral island, it may be accepted as certain that it can not withstand unassisted the competition of an ordinary tropical flora of vines, shrubs, and trees. Such arguments as that of Stoll prove, in fact, too much; for few things can be more certain than that many settlements have been made and abandoned in the coast districts of Guatemala within the last four centuries, and the complete disappearance of the cocoanuts, if a fact, furnishes emphatic testimony to the dependence of the species upon man, but gives us no inkling concerning its presence or absence among the pre-Columbian Indians of this or any other region.

THE ORIGINAL HABITAT OF THE COCOA PALM.

But if the littoral distribution of the cocoanut is the result of human effort, where did the natural development of the species take place? The literature of tropical agriculture abounds in statements to the effect that the cocoanut is strictly a shore plant, and the botanist Spruce, one of the ablest students of palms, held this opinion and believed in a Pacific origin.

The cultivation of the cocoanut is limited to the regions bordering the Atlantic and Pacific oceans. As we ascend the Amazon it gradually becomes sterile. At Manaos, 800 miles up, the fruits appear fully formed externally, but are invariably empty. At San Carlos del Rio Negro, almost exactly midway between the two oceans, there were, in 1854, two well-grown cocoa palms which had never even flowered.²

Nevertheless, it is now well known that many plants which were formerly supposed to belong strictly to the strand vegetation of oceanic coasts are also to be found in elevated regions. Thus Schimper has shown that in Java many strand species reappear on the volcanic mountains of that island, though absent from the intervening forest belt. Though this possibility seems never to have been considered, there is nothing violently improbable in the idea that the original home of the cocoanut was in some of the sheltered valleys of the equatorial Andes where elevation moderated and equalized the temperature,

¹ Guatemala, p. 117, (Leipzig, 1886).

² Journ. Linn. Soc. London, vol. 11, p. 80 (1871).

and the volcanic soil furnished the alkalinity which the species apparently finds congenial on the seashore, and which it is unable to obtain in inland localities having a heavy rainfall. The cocoanut resembles the date in this preference for alkaline soils, but differs in being much more sensitive to extremes of temperature.

The limited distribution of the great majority of the species of palms has already been remarked, so that there is nothing exceptional in the supposition that the cocoanut may have remained confined to a very small area until it made its way to the coast and was exploited by man as one of the few useful strand species.

And notwithstanding the general opinion to the contrary, the cocoanut is not an exclusively littoral or sea level species. It flourishes, for example, at Bangalore, in the middle of the southern part of the Hindostan Peninsula, nearly 200 miles from the coast, and at an elevation of nearly 3,000 feet. In the region of the Ganges and Brahmaputra it has been carried inland 150 or 200 miles, and even to Patna and Lucknow, though at the latter place the nuts are said not to ripen. Pickering's "Races of Men" furnishes a statement that in semiarid Arabia the cocoanut is cultivated "in the interior country back of Muscat." According to Dr. Edward Palmer thousands of cocoanut palms are grown in the dry and somewhat elevated region about the city of Colima, Mexico, and it has also been reported at Merida, Yucatan. In none of these places, however, is there any indication that the tree is indigenous, and according to Seeman numerous unsuccessful attempts have been made to grow it in the central parts of the Isthmus of Panama. But it is in South America, the home of all the other species of Cocos, that we find the greatest probability of an indigenous inland existence of the cocoa palm. Cieza de Leon described in the first half of the sixteenth century palms from this region which may have been cocoanuts:

The site is 23 leagues from the city of Cartago, 12 from the town of Anzerma, and 1 from the great river, on a plain between two small rivers, and is surrounded by great palm trees, which are different from those I have already described, though more useful, for very savoury palmitos are taken from them, and their fruit is also savoury, for when it is broken with stones milk flows out, and they even make a kind of cream and butter from it, which they use for lighting lamps.

Probably because of the general belief in the strictly littoral distribution of the cocoanut Markham has conjectured that this statement refers to *Ceroxylon andicola*, a palm which Humboldt reported from the region of Cartago, but which grows on high declivities, not in the river plains. Moreover, it is the waxy secretion of the trunk of *Ceroxylon* which is burned, not a cream or butter made from a milk-producing fruit. The apparently unnecessary statement that "their fruit is also savoury" doubtless implies a reference to the pixiuare

palms (*Guilielmia*?) of which the outer layer or husk is fleshy and edible, not the kernel as in the cocoanut. Cieza de Leon also described numerous small lakes, springs, and pools of salt water in the Cauca Valley between Antioquia and Popayan, but especially at Cartago.

But the final testimony to the existence of the cocoanut palm in the interior regions of Colombia is that of Humboldt, who in giving an account of the finding of healthy and vigorous trees at Concepcion del Pao, Venezuela, a station about midway on his journey between Barcelona and Angostura, declares that he and Bonpland also saw "fine cocoa palms" repeatedly during their travels in the upper part of the valley of the Magdalena River of Colombia, 100 leagues from the coast.¹

As already stated, the derivation of the varieties of the cocoanut by human selection has taken place in the Malay region, and not in America. It is, however, known that the cocoanuts shipped from the Colombian port of Cartagena are far superior to others produced in America, and apparently they also exceed those of the East Indies in thickness and quality of flesh, so that they are greatly preferred for confectionery purposes. This fact may have both theoretical and practical importance, since it suggests the possibility that, in spite of universal opinion, the cocoanut may be not only an inland species, but that it may actually have suffered deterioration through long cultivation in an unfavorable habitat.² The thicker meat of the Colombian nuts is a suggestion in the direction of having the kernel fill the shell, the normal condition in all related palms. In fact, it is very difficult to understand why the cocoanut should have carried the development of the shell so far beyond the needs of the kernel. If the wild ancestral type of the cocoanut still exists in the mountains of Colombia we may find that its flesh, if not solid, is at least thicker and more highly flavored than that of any coast-grown nuts, and that the seed for new plantations should be obtained from the wild, instead of from the too-long domesticated stock.

¹ Humboldt and Bonpland's *Reise*, vol. 3, p. 212 (Wien, 1830). Seeman's version of the same note (*Popular History of the Palms*, London, p. 155, 1856) differs substantially in omitting the statements regarding the healthy condition of the palms in these interior localities.

² Though romance and poetry have always linked together reef and palm, yet truth to tell, the cocoanut does not attain its greatest luxuriance upon the low reef islands. To an eye, not to mention an appetite, accustomed to the cocoanuts of New Guinea, the fruit of Funafuti seems to be dwarfed and stunted, and the palm trunks to be small and slender. A hundred nuts on a stem is a maximum yield for Funafuti, but double that amount is obtained elsewhere. "As big as a Rotumah nut," is a phrase often heard upon Funafuti, the richer soil of that high island producing larger nuts than the atolls; the shells of very large nuts being valued for flasks and toddy vessels.—C. Hedley, *Australian Museum, Sydney, Memoir III*, pt. 1, p. 23 (1896).

THE DIRECTION OF THE TRANSPACIFIC DISTRIBUTION.

In addition to the testimony already noticed as indicating a rather recent arrival of the cocoa palm in the Indian Ocean, the probabilities of a westward rather than an eastward distribution of the species are strongly suggested by an argument brought forward by Seeman¹ as favoring a Polynesian rather than an Asiatic origin. The Polynesians, like other aborigines of the tropics, are fond of fermented drinks, but they are quite unacquainted with the use of the sap of the cocoanut or of other palms for this purpose, and, like the aborigines of the American tropics,² they have recourse to infusions of roots in which fermentation has been induced by preliminary mastication in the human mouth. In the Malay region and in tropical Asia this custom seems not to exist, the juices of several Asiatic palms having furnished from remote times the basis of fermented drinks and a variety of other useful substances. Even the word "toddy" has been traced back to the Sanscrit without change, though scholars prefer to write it *tade*.

Had the Polynesians, therefore, once known the process, they would probably never have forgotten so easy a way of obtaining sugar, vinegar, yeast, and a pleasant drink, the strength of which may be regulated by time to any man's taste. So either the Polynesians could never have come from Eastern Asia, or else, after spreading over the South Sea, ages must have elapsed before the cocoanut made its appearance in those waters, so that the process of toddy making (there being no other suitable Polynesian palm to operate upon) had been entirely forgotten, and even disappeared from native traditions.

This amounts to the proposition that if the Polynesians originated in Asia they left that continent before the invention of toddy, and before the cocoanut came into use, or at a period so remote as not to correspond to the current supposition that the Polynesian occupation

¹ *Flora Vitiensis*, p. 276 (London, 1865-73).

² To a very limited extent use was made in America of the juice of palms. In Central America wine was made from the juice of *Acrocomia*. That this was an indigenous and not an introduced custom is indicated by the fact that *Acrocomia* is a strictly American genus, and that, although it extends from Mexico and Cuba to Brazil and Paraguay, the drinking of its juice seems to have been localized in Central America in regions where one of the species, *A. vinifera*, is said to be extremely abundant. That the custom was truly aboriginal and not brought from the Philippines by Spanish agency is also proved by the fact that it was observed by Columbus on his fourth voyage. Moreover, the palm was not tapped in the Asiatic manner, but the juice was squeezed from its pith, necessitating the destruction of the tree.

In Colombia, Humboldt describes the natives as securing wine from *Cocos butyracea* by felling the trees and excavating a cavity in the upper part of the trunk, in which the juice continued to exude for eighteen or twenty days.

The art of collecting tuba, as now practiced in Mexico, is believed to have been introduced from the Philippines at a comparatively recent period.

of the Pacific is a matter of a few centuries only.¹ Seeman had already dismissed the idea of an American origin of the cocoa palm, but finding it unreasonable to believe that both the Polynesians and the cocoanut came from Asia, he was impelled to raise the question whether the direction of the Polynesian migration has not been misinterpreted.

The light-skinned Polynesians are assumed to be of a Malay stock, and to have migrated somewhere from Eastern Asia. . . . Did these Polynesians leave the cradle of their race before the cocoanut tree had found its way to it? Or are we to assume that they have migrated with the trade wind rather than against it; that Malayan Asia was peopled from Polynesia rather than Polynesia from Malayan Asia?

And even if it be admitted that the Polynesians have never been in Asia, other facts remain which can scarcely be explained except by supposing that the cocoanut also passed from east to west. At the time of Captain Cook's visit Forster found two names at Tahiti connected with the cocoanut palm, *nia* for the fruit and *ari* for the tree. Although this distinction is often lost in the islands to the westward, yet both names in numerous modifications have a very wide distribution throughout the Pacific, the Malay region, Hindustan, Arabia, and Madagascar. The word *nia* becomes *niog* in the Philippines, and in other localities suffers a vast number of other changes, of which the following samples may suffice: nu, niuh, njo, nieor, nieo, niau, nikau, njog, nivel, niwer, niyur, nidjoe, nieh, nicoëra, njioer, noohhoe, and nijor. The other term *ari* is supposed to be represented in various Polynesian groups by haari, hari, erei, and akari, and has been conjectured to be the original of the Maori *kakari*, and may well be the root of the Arabic *harel*, and the extremely numerous Hindustan forms like nari, naril, narel, narjil, nardjil, and narikel. It can scarcely be denied that the existence of such series of names, when used for the same product by peoples separated by thousands of miles and differing totally in racial characteristics, languages, and customs, affords another proof that the cocoa palm was not distributed by the waves, but by human beings engaged in colonization or commerce.

¹ This idea has undoubtedly been fostered by the fact that the occupation of many of the small coral islands and groups of the Pacific is obviously recent, as must, indeed, be the case where the land itself has existed for only a few centuries. Thus islands of the Ellice Group, to the north of Fiji, were settled in historic times from the Gilbert Group, still farther to the north. It is also of interest to note that the cocoanuts are also known to have been introduced from the north and that the natives make toddy and do not use kava, facts which are used by ethnologists to show that the people of the Gilbert Group were derived from Micronesia and not from Melanesia or Polynesia. According to Captain Moresby the Papuans of the coasts and islands explored by him in 1873 used neither toddy nor kava.

"We never saw any intoxicating drink among the Papuans, and were struck by the peculiarity, as the making of ava is general amongst the South Sea Islanders." See Moresby, *Discoveries and Surveys in New Guinea and the D'Entrecasteaux Islands*, p. 324. (London, 1876.)

The differentiation of the names both in number and complexity is from east to west, and in the Viti (Fiji) Islands we have an additional indication that the people who brought the name had been acquainted with the cocoanut before they met with the several other species of palms indigenous in that group of islands. This is inferred from the fact that although the name *nia* applies especially to the nut rather than to the tree among the Polynesians, it is used by the Melanesians of Viti as a generic term to include all the local palms. The tendency of primitive races generally is to have separate names not only for each species, but for varieties and parts of useful plants, and according to Seeman the Fijians are "the only people who in their barbarous state had a collective term for the palms." But that the name elsewhere applied only to the cocoanut was employed for this generic use can scarcely mean anything else than that the cocoanut was known and named before the other Vitian palms were encountered. For if we think of the original Vitians as aboriginals of their own islands they should be expected to have had separate names for their palms as for other indigenous plants, and the cocoanut, if introduced by natural or accidental means, would, at the most, have received the name of one of the native species. But that the palms of Viti should all be designated as different kinds of *niu* or cocoanuts can scarcely be interpreted in connection with the general distribution of that name except as indicating that the people who brought the name *niu* to Viti were already familiar with the cocoanut, but had not come in contact or, at least, had not given names to other Pacific palms until they reached Viti, where the Malayan palm flora begins to make its appearance. In Samoa, the first archipelago to the east of Viti, where the name *niu* is also used for the cocoanut, there are only two indigenous palms, and these are apparently so rare and unimportant that they have received no native names.¹ In Viti, however, Seeman found twelve indigenous palms, several of which grow at comparatively low elevations and are used for timber and other economic purposes. There is even a native sago palm, *Sagus vitiensis*, but this was also called *niu* (*niu soria*), a fact further at variance with the idea of an emigration from the Malay Archipelago, where the sago palm furnishes so important an article of diet. Strangely enough, Seeman found on one of the Viti islands another name, *sogo* or *songo*, evidently contributed by the Melanesian or Papuan constituent of the population of Fiji, but as a name merely, the art of extracting sago being unknown in Fiji until taught by Seeman.

These facts taken together seem to furnish the hitherto missing clue to the origin and direction of the migration of the race which brought the Malayo-Polynesian language, the cocoanut, the sweet potato, the yams, and other American food plants into the Pacific; the race which

¹ Reinecke, Die Flora der Samoa-Insel, in Engler's Bot. Jahrb., 25, p. 588 (1898).

was at one time powerful enough to impress its language, social organization, and domestic arts upon the black Melanesians, who subsequently absorbed their conquerors and formed with them the remarkable composite peoples found by Europeans in the Pacific. The differentiation of the cocoanut varieties, together with the ethnologic differentiation of the Pacific peoples themselves, give us time factors ample for the subsequent Asiatic amalgamation and development of the Malayoid races, which doubtless received great stimulus from the experiences of such a migration and may have had a wide influence in the organization of the primitive civilizations of Asia, even far beyond the boundaries of direct power or physical contact. Traces of such influences far within the mainland of Asia have been interpreted by anthropologists as meaning the Asiatic, and even the Caucasian, origin of the primitive Polynesians; but all such arguments from philology and racial characteristics, after all, only prove the relations, and do not declare the nature of the contact or the direction of the primitive migrations. Cultivated plants, on the other hand, are definitely recognizable, permanent, and unmistakable entities on which human civilizations depend, and from which civilized man can not detach himself. Even the substitution of food plants is an extremely slow and difficult process, often necessitating profound social and economic changes, and leaving traces for centuries in language and daily life.

SUMMARY OF DE CANDOLLE'S ARGUMENTS.

In attempting to displace De Candolle's time-honored opinion it is perhaps desirable to go over in brief detail his formulated arguments. These are twelve in number, two in favor of and ten against an American origin. The first of the favorable considerations has been noticed already—the existence of the eleven other American species of *Cocos*. The second is that the trade winds of the equatorial region of the Pacific would tend to carry floating objects to the westward. This is offset in theory, as it might be in practice, also, by the first of the negative arguments, that the currents of the equatorial Pacific would carry objects in the opposite direction, or from west to east. The second objection to an American origin is the fact that "the inhabitants of the islands of Asia were far bolder navigators than the American Indians," rendering it more likely that they would be carried by "tempests or false maneuvers" to the American coast. The eastern part of the equatorial Pacific is, however, notoriously free from storms, and the seafaring skill of the islanders, together with the above mentioned westerly trade winds, would have tended to protect them from the disasters suggested. Instead of being dependent upon accident and conjecture we have historical evidence that the Peruvians knew the loca-

tion of inhabited islands in the Pacific, information probably obtained from some of the conquered races of the coast region.

The third point is the greater area of distribution in Asia, which proves only that the cocoanut was more appreciated there than in America. The next three counts are on multiplication of varieties, uses, and names in Asia, which have already been touched upon.

In the next objection it is considered improbable that "the ancient Mexicans and inhabitants of Central America would have neglected to spread the cocoanut in several directions had it existed among them from a very remote epoch." It has been shown above that the species might have been American and still, like most other palms, not widely distributed. Moreover, there is no evidence of extended movements among the aboriginal peoples of tropical America. The more recent of the superior tribes were of temperate origin, and even the cacao of tropical Mexico and Central America had not been exchanged for the cocoa of tropical Peru, plants far more valued than the cocoanut. Under number eight it is alleged that if the cocoanut had been present in America before Pliocene or Eocene times it would have been found on both sides of the continent, a point which the evolution and distribution of other palms does not indicate to be well taken, or to have bearing upon the question. The ninth objection is that there is no record of ancient existence in America, while Sanskrit names indicate its presence in Asia three thousand or four thousand years ago. This seems to be due to the literary backwardness of the American aborigines and is no fault of the palms. The tenth and final item is based on the wide diffusion of similar names among the Malays and others, but it has been shown that the names indicate a westerly and not an easterly direction for the trans-Pacific journey.

CONCLUSIONS.

It thus appears that among De Candolle's ten reasons for the Asiatic origin of the cocoa palm none is based on facts incompatible with the present view that the species originated in America.

An introduction of the cocoa palm to America by the Spaniards in the fifteenth century is highly improbable by reason of the difficulties of securing and transporting living nuts from the Far East, with which the Spaniards were not in communication, and there are neither records nor traditions establishing or even suggesting such an introduction.

The existence of the cocoanut in great abundance in Central America in the early years of the sixteenth century is established by the extended and circumstantial record of Oviedo, supported by the testimony of Cieza de Leon, Acosta, and Hernandez, all of whom evidently considered it an indigenous American product.

The reported introductions of the cocoanut during the sixteenth century to Jamaica, Guiana, Brazil, and West Africa afford no indication of importations from Asia, but are much more satisfactorily explained on the supposition that the nuts were brought from Central America.

No other genus or species of palms is common to America and Asia or the Polynesian Islands. The Asiatic origin of the cocoanut would therefore be an anomaly of distribution for this entire order of plants and is thus, from the botanical standpoint, highly improbable.

The distribution of the cocoanut in the Pacific and Indian oceans was not, however, a unique achievement for man, but was also accomplished with numerous seedless varieties of the sweet potato, taro, breadfruit, and banana; the last having been introduced also into tropical America in prehistoric times. Numerous tropical economic plants, including the sweet potato, bottle gourd (*Lagenaria*), true gourd (*Cucurbita*), cowhage (*Mucuna*), yam bean (*Pachyrhizus*), and one or more species of true yams, all probably of American origin, existed in Polynesia and in the Malay region in prehistoric times.

Although the derivation of numerous varieties of the cocoanut in the Malay region implies long existence in that part of the world, there is both traditional and historical evidence of a comparatively late arrival in Ceylon and in the western part of the Indian Ocean.

The generally accepted theory of the distribution of the cocoanut by ocean currents is not supported by direct evidence. At the same time, the cocoanut, as a seed, is delicate and short-lived, and special conditions and care are required for successful germination and the growth of vigorous seedlings.

The cocoa palm is found in the Pacific and elsewhere only on inhabited islands and coasts, and is unable to maintain an existence when subjected to the competition of the wild vegetation of tropical shores and forests. In the Pacific and Indian oceans the distribution of the cocoa palm is continuous with that of agricultural peoples, but the species did not establish itself anywhere on the extensive tropical coast line of the Australian continent, the aborigines of which were non-agricultural.

Contrary to general opinion, the cocoa palm is not confined to the seashore or to the sea level, but has been found to thrive in several elevated inland regions where the soil conditions are favorable, and where temperatures are moderate and equable. The original habitat of the cocoa palm is to be sought in South America, the home of all the other species of *Cocos* and of most of the closely related genera. More specifically, the probabilities favor the alkaline regions of the Andes of Colombia, where it has been reported by Cieza de Leon and Humboldt in valleys remote from the sea.

The failure of the Polynesians to use the juice of the palm for toddy and other purposes indicates the improbability of a migration from Asia, while the Polynesian method of making fermented drinks from masticated roots agrees with the custom of the natives of tropical America.

The agreement and distribution of the Polynesian, Melanesian, Malayan, and other Oriental names for the cocoanut indicate a westward migration for the race which introduced it in the western Pacific.

The ethnological facts which have been thought to prove an Asiatic origin for the Polynesians can be accommodated by the supposition of a westward migration of a primitive culture race to the Malay archipelago and the Asiatic continent.





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